Subject of invention

1. A filter for water containing a housing equipped with an inlet branch pipe, an outlet branch pipe and a drain branch pipe with corresponding shutoff valves and the main filtration element made from an ion-exchange material and having the inlet and outlet surfaces for the liquid being filtered, differing by the fact that the ion-exchange material of the main filtration element is made to be volumetric, of the required geometrical shape, is armoured by a load-bearing reinforcement attached to a perforated support and constitutes a continuous porous framework from microglobules with pores of the required size to be determined by the necessary parameters of cleaning, at that the filtration mass volume of the element material is determined according to the following expression:

$$V_{fl} = \frac{Q \cdot L^2}{k \cdot h_v}$$ – for the flat filter;

$$V_{cyl} = \frac{Q \cdot L^2 (L + d)}{k \cdot h_v \cdot d}$$ – for the hollow cylindrical filter;

$$V_{con} = \frac{Q \cdot L^2 (2L + d_k + D_k)}{k \cdot h_v (d_k + D_k)}$$ – for the conic filter;

where Q is the required flow-rate of the liquid being purified, kg/s;

L is the filtering layer thickness, mm;

d is the internal diameter of the cylindrical filter, mm;

d_k and D_k are the internal diameters of the upper and lower cross-sections of the conical filter, mm;

k = 0.12 - 0.14, mm/s, is the experimental coefficient for the material obtained with the spatial globular structure; in doing so, the inlet surface of the main filtration element is covered

by an additional filtration corrective protection layer of a finely grained substance introduced in the form of powder via a loading valve in the housing cavity into the flow of filtration liquid deposited on the inlet surface of the main filtration element and dynamically retained on it by the liquid velocity head, the powder granule size is greater than the size of ion-exchange material pores, and the additional volume being introduced into it, depending upon the main filtration element shape, is determined according to the following expressions:

$V_{add} = HB\Delta$, mm², for the flat filter;

$V_{add} = \pi H\Delta(D+\Delta)$, mm³, for the cylindrical filter;

$V_{add} = \pi H(R\Delta + r\Delta + \Delta^2)$, mm³, for the conical filter;

where H is the filtration element height,

B is the filtration element width, mm;

D is the filtration element diameter, mm;

R is the radius of the lower conical base, mm;

r is the radius of the upper conical base, mm;

Δ is the required thickness of the protection layer, mm.

2. A filter as per Item 1, differing by the fact that the filter is made in the form of a hollow cylinder.

3. A filter as per any of Items 1, 2, differing by the fact that the ratio of the inlet surface of the filter to its outlet surface equals to 1.6-2.6.

4. A filter as per Item 1, differing by the fact that the filter is made in the form of a cone.

5. A filter as per Item 1, differing by the fact that the filter is made flat.

6. A filter as per any of Items 1, 2, 3, 4 and 5, differing by the fact that the volumetric reinforcement is made from a fibrous non-woven sheet material, for example, synthetic wintersiser.

7. A filter as per any of Items 1, 2, 3, 4, 5 and 6, differing by the fact that a chemically inert substance, for example, perlite, is taken as the filtration material of the protection additional layer.

8. A filter as per any of Items 1, 2, 3, 4, 5 and 6, differing by the fact that a chemically active substance, for example, resorcin-formaldehyde resin, is taken as the filtration material of the protection additional layer.

9. A filter as per any of Items 1, 2, 3, 4, 5 and 6, differing by the fact that dolomite is used as a material of the additional protection layer correcting the pH value of water being filtered.

10. A filter as per any of Items 1, 2, 3, 4, 5 and 6, differing by the fact that a bacteriostatic substance, for example, active silver, is introduced into the material of the additional protection layer.

11. A filter manufacture method including preparation of the reaction mixture of polymer-forming reagents and conduction of the reaction with obtaining of the filtration element of the given shape, differing by the fact that at the reaction mixture preparation one shall first dissolve resorcin in water, then warm up the solution up to 40°-50°C, then introduce the catalyst, stir up and add formaldehyde after homogenisation of the solution, hold at the room temperature until the solution gets turbid; then the polymer solution obtained shall be poured into the mould, with the perforated support and the load-bearing reinforcement being preliminarily installed in it, such mould being made in the form of a sheet non-woven volumetric material laid in one or several layers and fixed on the perforated support; then the mould shall be thermostated in two stages: first the polymer is to be held until a gel is generated at the pouring temperature and after that at the temperature of 80°-95°C; after cooling to the room temperature the porous ion-exchange element obtained shall be removed from the mould and placed into the filter housing, which is to be filled by a suspension of a finely grained hydrophilous powder containing substances correcting the properties of filtered water, which granule size is greater that the size of ion-exchange element pores; the suspension shall be bubbled; an easily breakable additional protection corrective filtration layer shall be created on the inlet surface of the element by settling granules of the above-mentioned powder on the inlet surface of the element, and after its complete coverage by a layer of the given thickness, the layer shall be retained by the velocity head of the flow and after contamination the layer shall be removed by the back flow of the liquid.

12. A filter manufacture method as per Item 9, differing by the fact that the bubbling of the suspension of a finely grained powder is carried out by the flow of the liquid being filtered.

13. A filter manufactur method as per Item--, differing by the fact that the bubbling of the suspension is carried out by aeration of the liquid.

14. A method as per Item 8, differing by the fact that in order to obtain the element pore size equal to 0.001-0.02 μm, the initial concentration of polymer-forming reagents is taken to be 30-40 mass % and the ratio of formaldehyde-resorcin equal to 2.5÷1 moles, with the ratio of the number of cross-linking ether bonds to the number methylene bonds being equal to 1.2; in doing so, the powder granule size for the protection layer generation shall be taken equal to 0.03-0.3 μm and the protection layer thickness shall be made to be 0.01-0.5 μm.

15. A method as per Item 8, differing by the fact that in order to obtain the element pore size equal to 0.02-0.2 μm, the initial concentration of polymer-forming reagents is taken to be 40-35 mass % and the ratio of formaldehyde-resorcin equal to 2.0÷1 moles, with the ratio of the number of cross-linking ether bonds to the number methylene bonds being equal to 1.15; in doing so, the powder granule size for the protection layer generation shall be taken equal to 0.3-4.0 μm and the protection layer thickness shall be made to be 0.05-0.2 μm.

16. A method as per Item 8, differing by the fact that in order to obtain the element pore size equal to 0.2 - 0.3 μm, the initial concentration of polymer-forming reagents is taken to be 35-25 mass % and the ratio of formaldehyde-resorcin equal to 1.8÷1 moles, with the ratio of the number of cross-linking ether bonds to the number methylene bonds being equal to 0.9; in doing so, the powder granule size for the protection layer generation shall be taken equal to 4.0-10.0 μm and the protection layer thickness shall be made to be 0.2-1.0 μm.

17. A method as per Item 8, differing by the fact that in order to obtain the element pore size equal to 3.0-8.0 μm, the initial concentration of polymer-forming reagents is taken to be 25-20 mass % and the ratio of formaldehyde-resorcin equal to 1.5÷1 moles, with the ratio of the number of cross-linking ether bonds to the number methylene bonds being equal to 0.8; in doing so, the powder granule size for the protection layer generation shall be taken equal to 10.0-25.0 μm and the protection layer thickness shall be made to be 1.0 μm and over.